



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,093	08/29/2006	Jiro Kondo	52433/861	7884
26646                      7590                      07/23/2010 KENYON & KENYON LLP ONE BROADWAY NEW YORK, NY 10004				
EXAMINER				
COHEN, STEFANIE J				
ART UNIT		PAPER NUMBER		
1793				
MAIL DATE		DELIVERY MODE		
07/23/2010		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

**Application No.**

10/591,093

**Applicant(s)**

KONDO ET AL.

**Examiner**

STEFANIE COHEN

**Art Unit**

1793

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 April 2010.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-16 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-16 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO/SB/CD)  
Paper No(s)/Mail Date 2/16/2010  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mellstrom et al (WO8902415).

Mellstrom teaches a method for the purification of silicon wherein the method is preferably carried out such that silicon is melted and heated to 1500-1600oC in a melting furnace, whereupon the slag forming agent is added. The particle size of the slag forming agent is not critical, but less fumes and less dust are obtained if coarser materials are used. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the slag forming agents would be in powder form because Mellstrom teaches a suitable particle size for the slag forming agents may be added in one or several runs.

The composition of the slag suitably is .1-50% by weight of solid chlorine compounds, 0-50% by weight of at least one compound selected from the group consisting of oxides, carbonates and hydroxides of alkali and or alkaline earth metals and 0-80% by weight of silica.

After the addition of the slag forming agents and heating for the desired period of time, the melt in the furnace consists of 2 phases, a lower silicon phase and an upper slag phase. Thus, the slag is a top slag. To be able to separate the silicon from the slag, it may be necessary to allow the slag to cool somewhat to cause it to set.

Further, the slag forming agents constitute the extraction phase ie some impurities pass from the silicon phase into the slag phase.

Regarding claim 2, Mellstrom teaches after the addition of the slag forming agents and heating for the desired period of time, the melt in the furnace consists of 2 phases, a lower silicon phase and an upper slag phase. Thus, the slag is a top slag. To be able to separate the silicon from the slag, it may be necessary to allow the slag to cool somewhat to cause it to set.

Regarding claims 3 and 6, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the interval time of adding the additives to discharging to achieve maximum purification of the silicon material.

Regarding claims 4-5 and 7, it would have been obvious to one of ordinary skill in the art at the time of the invention that the order of the addition of the slag materials would have no impact on the final silicon product as long as all the components are well mixed.

Regarding claims 8 and 10, it would have been obvious to one of ordinary skill in the art at the time of the invention to discharge already formed slag as many times as needed to obtain additional space for further treatment of the raw silicon having a boron concentration.

Regarding claim 9, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the interval time of adding the additives to discharging the formed slag to achieve maximum purification of the silicon material.

Regarding claim 11, it would have been obvious to one of ordinary skill in the art at the time of the invention to discharge already formed slag as many times as needed to obtain additional space for further treatment of the raw silicon having a boron concentration.

Further, Mellstrom teaches producers of solar cell silicon have especially wished for a boron reduction to 1-5 ppmw in the starting material, and this has not been possible with the prior art techniques.

Regarding claim 12, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the quantity of silica and sodium carbonate added to the molten silicon to obtain the purist form of silicon.

Regarding claim 13, Mellstrom, example 1, teaches the slag forming agents consisted of 250 kg CaO which can be considered the one compound selected from the group consisting of oxides, carbonates and hydroxides of alkali and or alkaline earth metals and 875 kg of SiO<sub>2</sub>.

Therefore, this would result in a mol ratio of the moles of silicon in  $\text{SiO}_2$  to moles of the alkali element in one or both of the carbonate of alkali metal and the hydrate of a carbonate of an alkali metal to be around 3.

Regarding claims 14 and 15, Mellstrom teaches the composition of the slag suitably is .1-50% by weight of solid chlorine compounds, 0-50% by weight of at least one compound selected from the group consisting of oxides, carbonates and hydroxides of alkali and or alkaline earth metals and 0-80% by weight of silica.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mellstrom (WO890215) as applied to claim 1 and further in view of Hurley (1992).

Although Mellstrom teaches a method for the purification of silicon, Mellstrom does not teach adding an additive to increase the viscosity of the slag.

Hurley, abstract, teaches a slag composition where the addition of alumina increases the viscosity and the Tc of the slag and therefore making the slag less corrosive.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate alumina as taught by Hurley in molten silicon/slag composition because Hurley teaches the alumina will increase the viscosity and the Tc of the molten silicon/slag mixture and therefore make the slag less corrosive.

***Response to Arguments***

Applicant's arguments filed 4/26/2010 have been fully considered but they are not persuasive.

Applicant argues Mellstrom uses a chloride compound in the method and further argues the "consisting essentially of" overcomes the use of the chloride. However, the claim merely says adding a solid consisting essentially of silica and a solid consisting essentially of a carbonate.... This does not exclude another solid consisting essentially of chloride also being added. As claimed, the solids added to the molten silicon during the "adding" step are not limited to only silicon dioxide and one or both of a carbonate or a hydrate of a carbonate.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEFANIE COHEN whose telephone number is (571)270-5836. The examiner can normally be reached on Monday through Thursday 9:3am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 5712721234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Stefanie Cohen

7/17/2010

SC

July 18, 2010

/Melvin Curtis Mayes/  
Supervisory Patent Examiner, Art Unit 1793